CDF Gigafitter Operational

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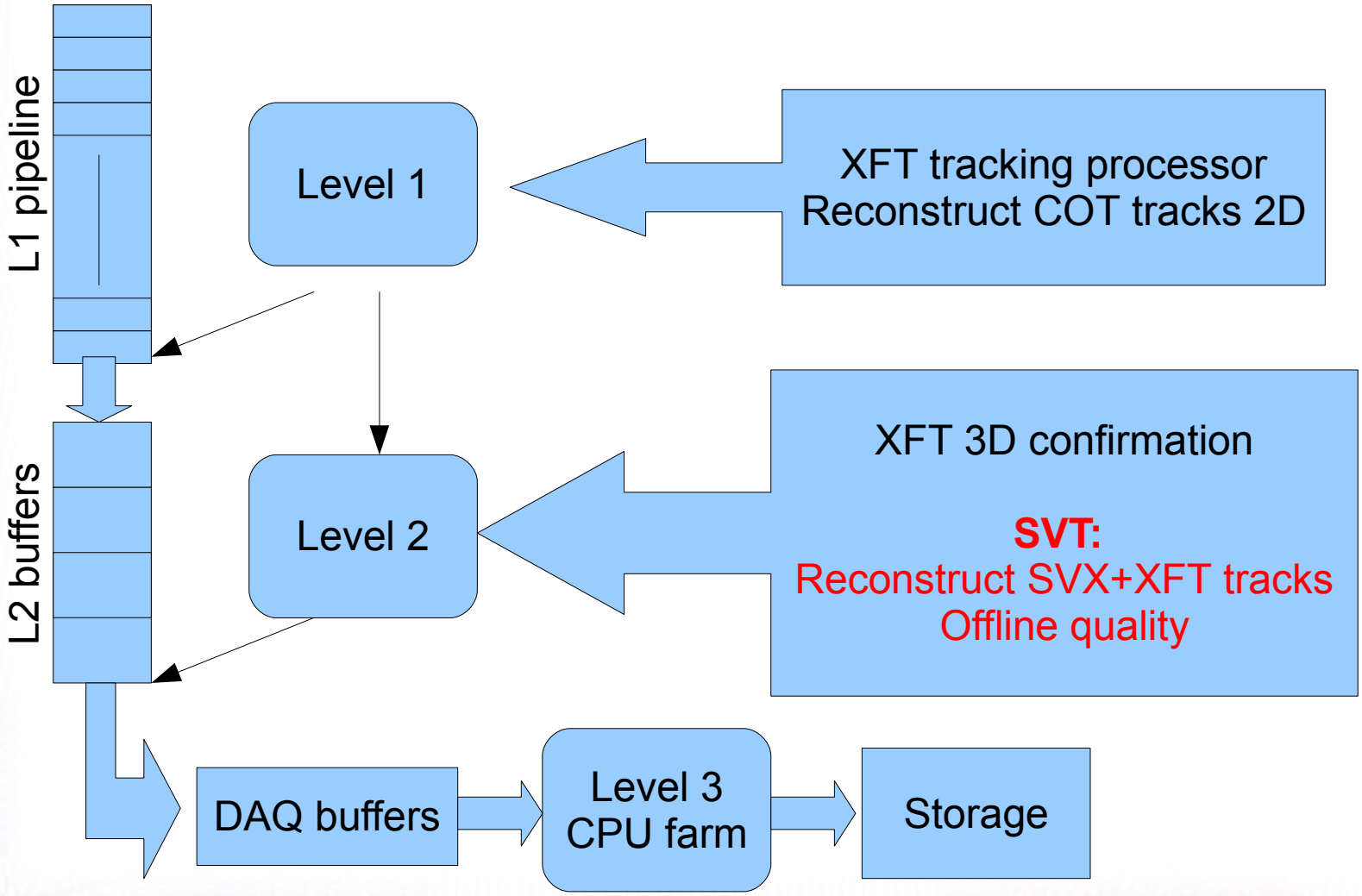
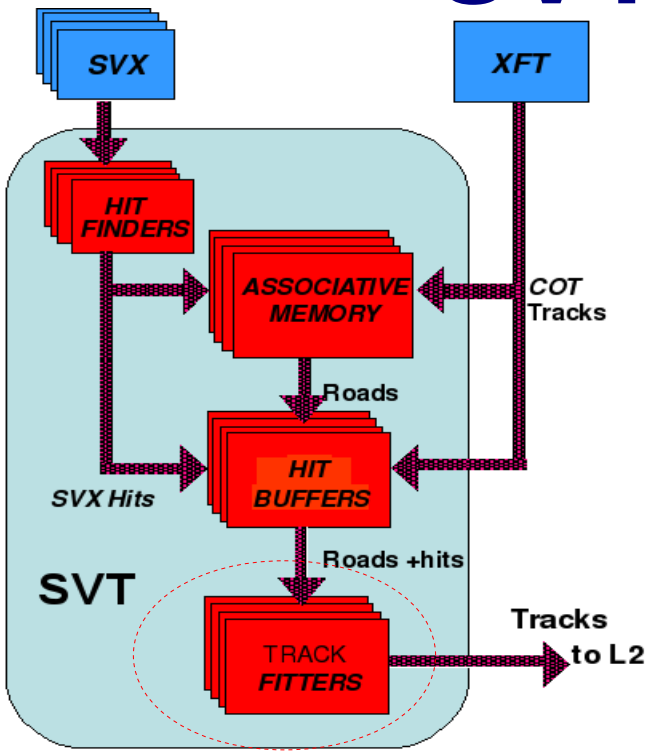
Tracking in CDF Trigger



SVT Processor

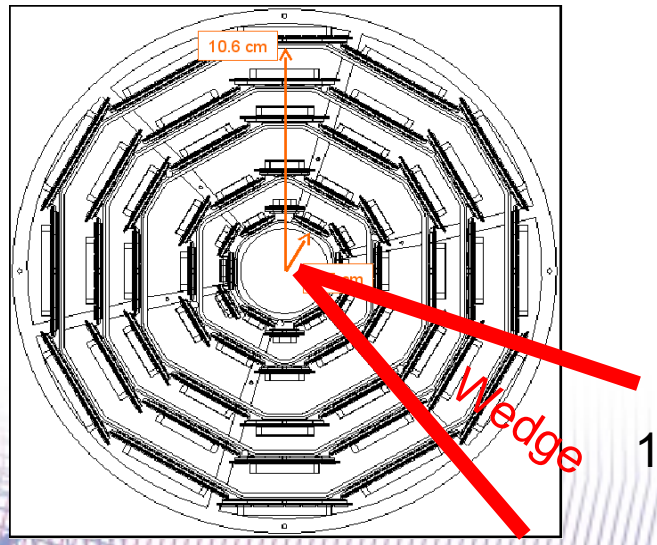


Dedicated processor made by 104 9U VME boards.

Two step algorithm:

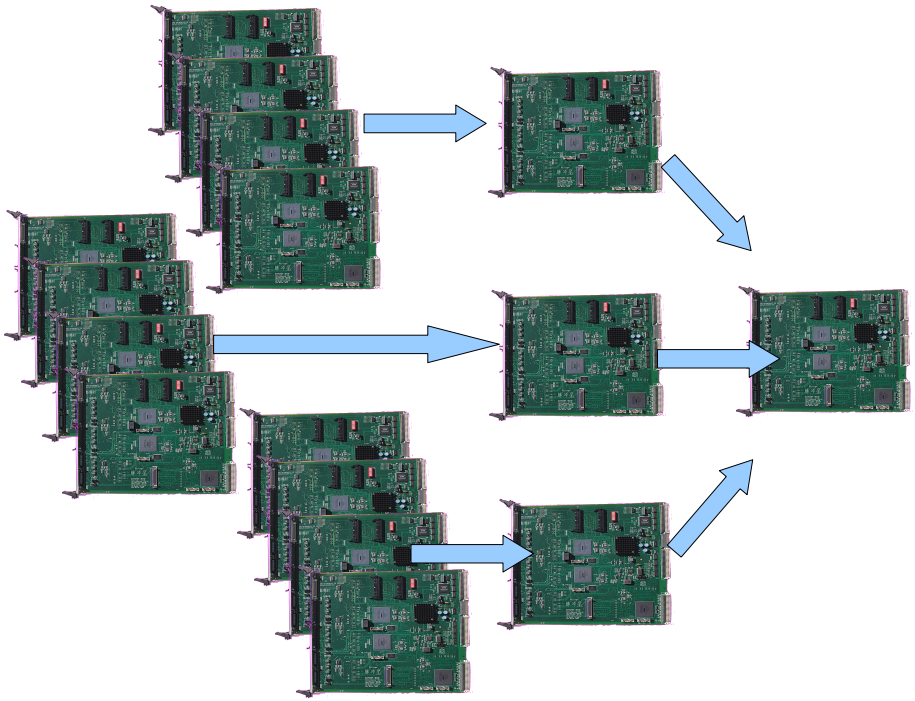
- Find low resolution tracks (roads) using pattern recognition with **Associative Memory**

- Fit high resolution tracks inside each roads using a linear fit with **Track Fitters**



12x parallel processors for each wedge

The TF++ system



Designed to perform the track fitting step of SVT.

16 9U VME boards:

- 12x TF++ boards (one per wedge)

- 4x Merger boards to merged the tracks data streams in one cable

Limited computing power → max 32 candidate tracks per road → a limit on road size → a limit on the acceptance

Approximate linear fit with extra constants pre-computed for each pattern → a limit on the pattern bank size → a limit on the acceptance

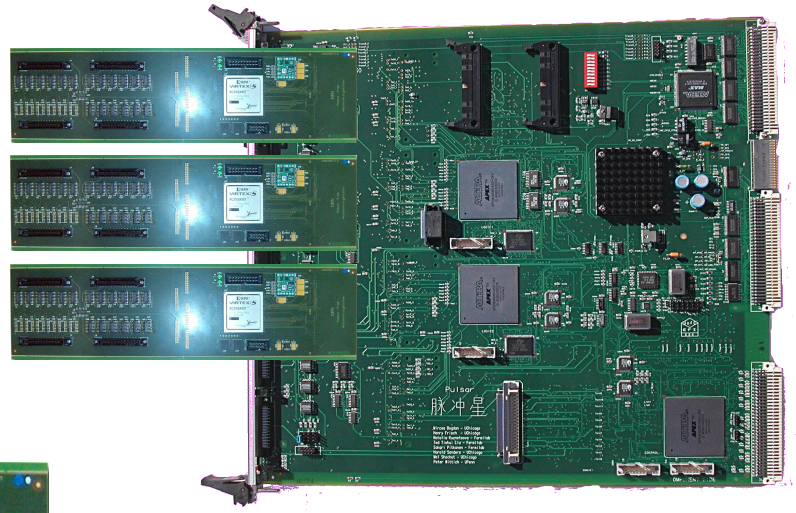
Fixed 4 hits choice in case of 5 SVX hits in a combination → discard potentially good tracks → a limit on efficiency

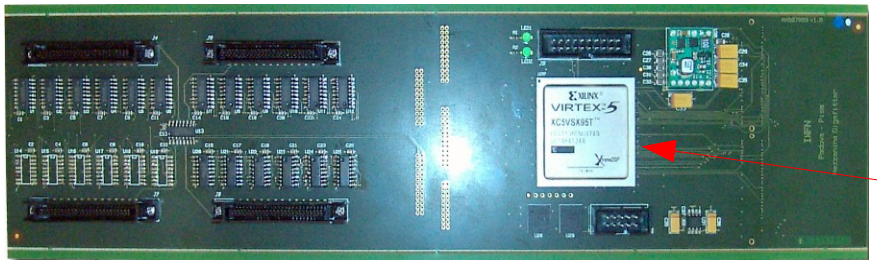
The GigaFitter upgrade

A **single** 9U VME board (Pulsar board) with 3 powerful mezzanines each with 4 inputs.

12 wedges processed in parallel.

Data streams merged on the board.





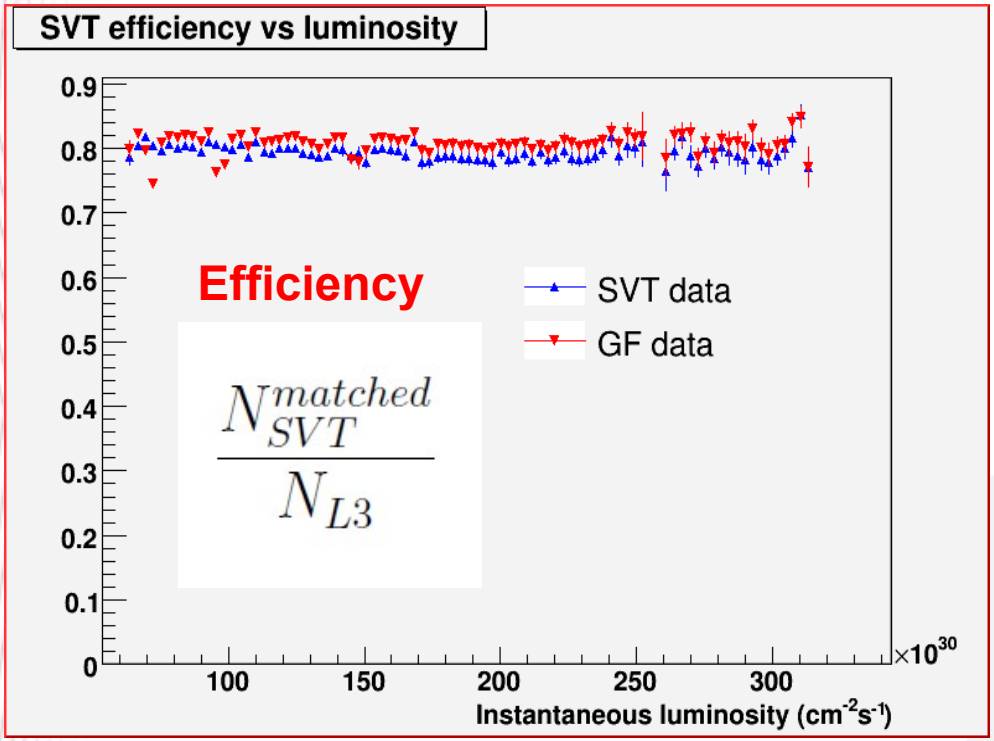
Virtex-5 SXT
640 DSP units
8.6 Mb of BlockRAM

1 fit every clock cycle @ 120 MHz on each wedge → no limits on combinations per road → no limits on road size

Full precision linear fit → no needs for extra constants → no limits on pattern bank size

All 4 hits combinations fitted in case of 5 hits, best choosen → no efficiency loss

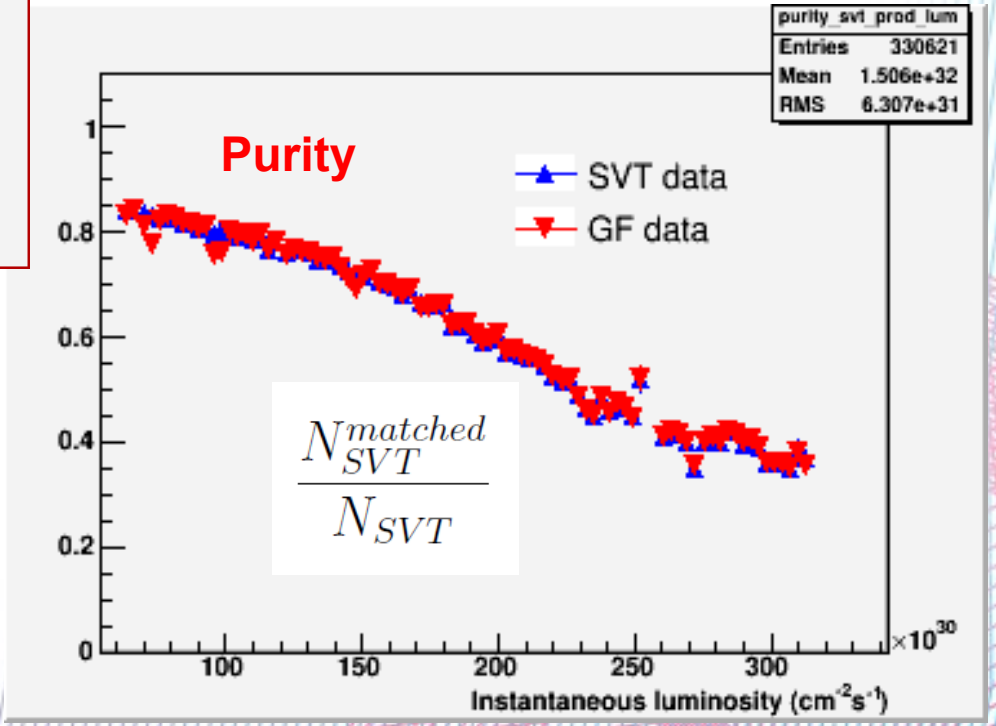
GigaFitter performances with current SVT patterns



The GigaFitter offers a little gain (average +2%) in efficiency wrt TF++ even with the same patterns:

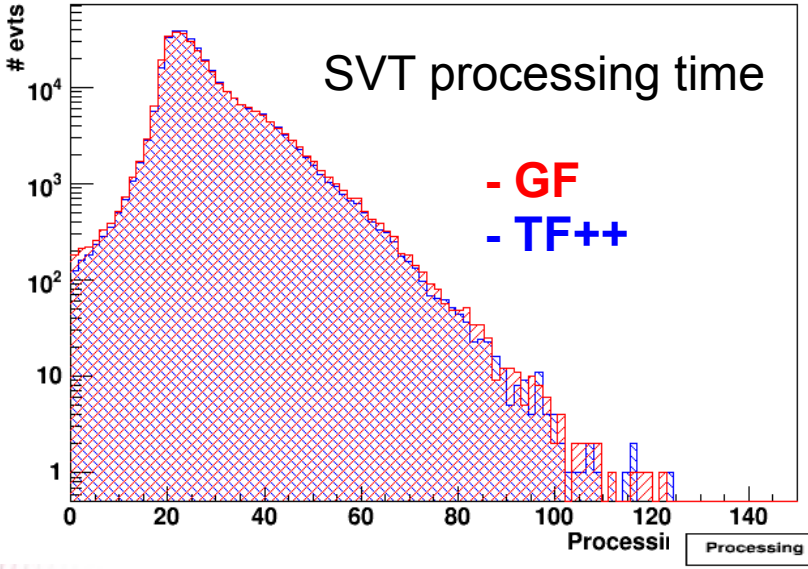
- Full precision fit

- Recover of tracks with 5 SVX hits



The purity of tracks found with the two systems is the same as expected with the same Data Banks.

GigaFitter performances with current SVT patterns

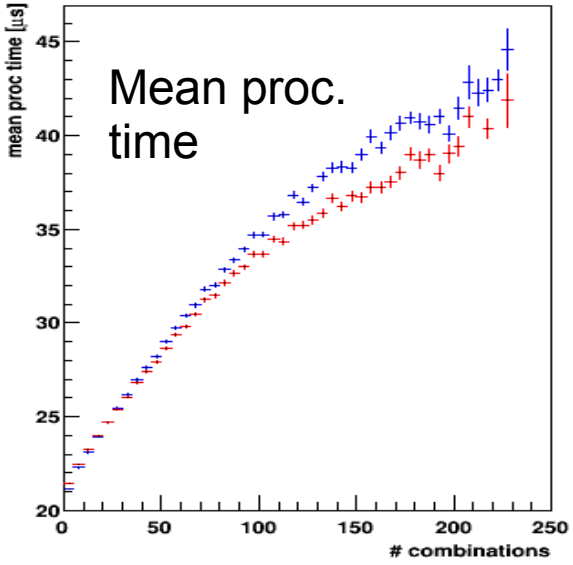


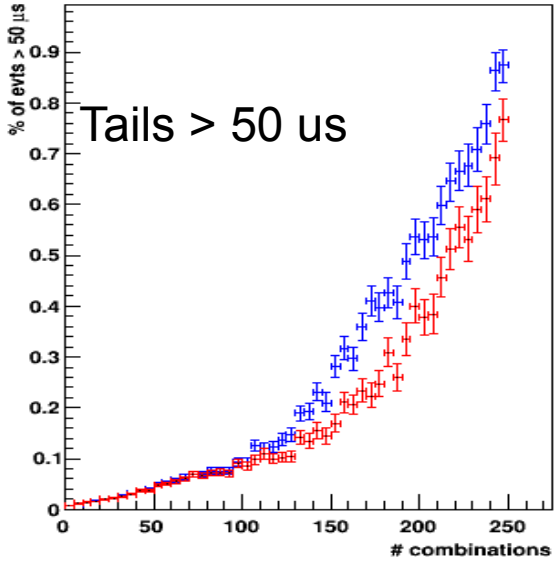
The global SVT processing time is the same with the two systems.

The track fitting part is a small amount of the total timing.

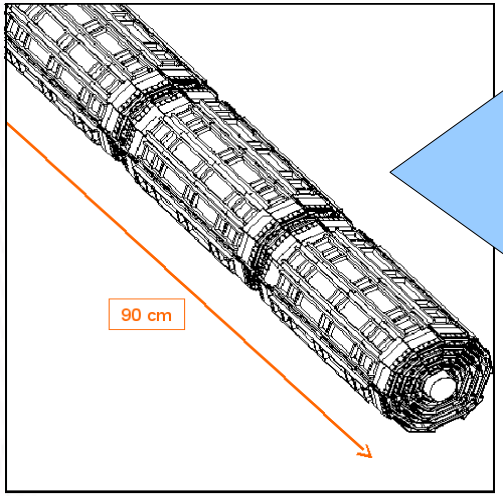
Timing vs. # of track candidates (hit combinations)

GigaFitter shows a timing <u>advantage</u> with **complex events** (many hit combinations, many tracks).





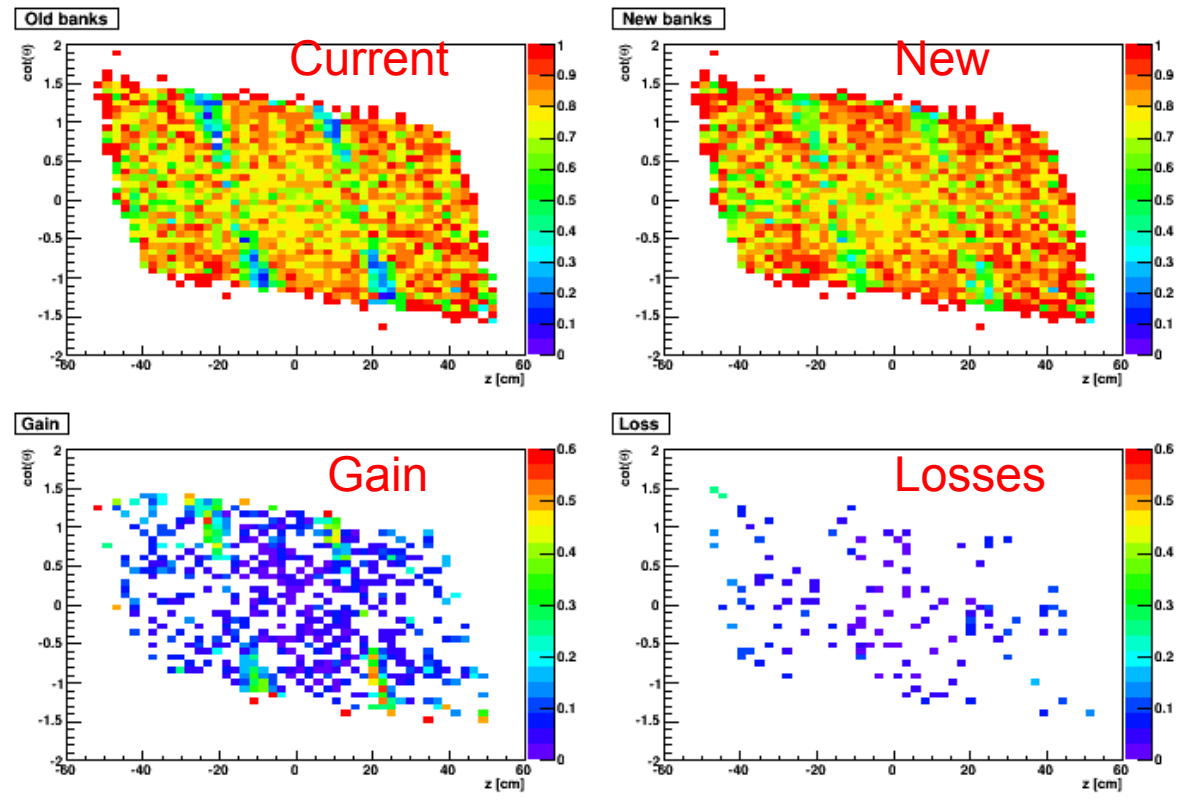
GigaFitter performances with possible new Data Banks



SVX is made by 3 mechanical barrels
Current SVT avoid patterns/tracks
Crossing barrels due to limited pattern
Bank size and lower fit efficiency
(misalignment of barrels)

With GF we can use a **larger bank** or **larger road size** to achive the more efficiency and recover crossing barrels tracks.

Plot shows efficiency vs zeta vs cot(θ) with current banks, new banks and gain and losses between the two.



Current GF status

- Two complete GF systems (main & spare) built
  - 3 extra spare mezzanines tested in Italy
- GF is installed in parasitic mode and running stable since december
  - Receives the same data of TF++ system
  - GF tracks are saved on tape
- GF has driven SVT for one store
- Currently at final review stage before commissioning

Conclusions

- The GigaFitter is a single board new generation track fitter for the SVT processor
  - 1 board replace current TF++ (12+4 boards)
  - Enhance SVT capabilities
  - Compatible with current SVT (with +2% efficiency gain)
- New possibility of tuning for SVT patterns to extend acceptance and efficiency
  - Recover barrel crossing tracks
  - Lower pT threshold
  - Larger impact parameter
  - ....